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AUTHOR Feldman, David; Elliott, Thomas A.
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ABSTRACT

A multidimensional oral hygiene curriculum appropriate for the moderately to profoundly retarded and composed of tooth brushing, flossing, and gum stimulation/massage is proposed. Task analyses are included for manual tooth brushing, utilizing an oral irrigation appliance, manual flossing, and use of an adaptive aid for flossing. Also provided are suggested procedures for individualized education program development, data collection, formative and summative evaluation, and forms for recordkeeping. (Author/DB)

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A DATA-BASED MULTIDIMENSIONAL ORAL HYGIENE CURRICULUM FOR THE SEVERELY AND PROFOUNDLY HANDICAPPED

A paper presented at the 58th Annual International Convention of the Council for Exceptional Children, Philadelphia, Pennsylvania
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David Feldman, Ph.D.
Thomas A. Elliott, D.D.S.

Dr. Feldman is an assistant professor at Texas Southern University, department of Special Education, School of Education, 242 K, Houston, Texas 77004

Dr. Elliott is a dentist in general practice, Biscayne Mall, Columbia, Mo. 65201

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The need to teach basic self-care skills and behaviors to mentally handicapped individuals has made the establishment of such behaviors a high priority objective of an increasing number of training efforts (Snell, 1978). One category of self-care behaviors that has received substantial attention while remaining the primary unmet health need of the handicapped is dental hygiene (Nowak, 1979). This is a rather broad area which encompasses a variety of complex skills as opposed to simpler self-care tasks (e.g., washing, dressing).

These dental hygiene skills include: 1) knowledgeable consumption of edibles; 2) toothbrushing; 3) gum massage and stimulation; 4) flossing; 5) preventive check-ups; and 6) elimination of damaging oral hygiene habits (e.g., grinding teeth). Curriculum designers in special education have focused their attention primarily on the development of content and methodology for teaching toothbrushing skills (e.g., Abramson & Wunderlich, 1972; Bender & Valletutti, 1975; Horner, Billionis & Lent, 1975; Horner & Keilitz, 1975; Lindford, Hipsher & Silikovitz, 1972; Mercer & Snell, 1977; Meyers, Sinco & Stalma, 1973). When dental practioners have focused on the needs of the retarded and other handicapped individuals they have limited their perspective to the expansion of dentistry through barrier-free offices as well as improved technical skills and services provided by dentists and oral hygienists (Cohen, 1960; Cohen, Winer, Schwartz, & Shklar, 1961; Connelly, 1963; Nickol, 1973; Scholle, 1979).

While it is commendable that the field of dentistry recognizes the special needs of the handicapped, the basic thrust of their energies

has been, in some respects, detrimental to the movement of normalization and decreased dependency of this population. Authorities in dentistry have failed to recognize that the best means of establishing good dental hygiene in the handicapped is not only through increased efforts and expertise of dental professionals in services provided, but also through systematic instruction of these individuals in all facets of dental hygiene skills and behaviors. This global oral hygiene instructional approach is necessitated by the qualitative and quantitative dental problems encountered with this population (Miller, 1965; Schub, 1963; Stocker, 1963; Wollin, Pollack, & Kraus, 1963). Even among nonhandicapped dental patients, a comprehensive oral hygiene approach has been well incorporated as a necessary aspect of sound preventative dentistry practices. Following this assumption further, one could surmise that even if independent toothbrushing behavior were achieved by the mentally handicapped, prevention of their oral hygiene problems would be only marginally achieved.

While professionals in special education have generated numerous curricula for developing appropriate toothbrushing behavior (e.g., Horner et al, 1975; Bender & Valletutti, 1975), their efforts have been minimized by substantial shortcomings. The deficiencies include: 1) neglect of other necessary oral hygiene skills (e.g., flossing), 2) lack of replicable methodology for severely and profoundly handicapped (e.g., Abramson & Wunderlich, 1972); 3) limited empirical support with mild and moderately handicapped adolescents with the majority of subjects failing to achieve independent functioning of toothbrushing skills (e.g., Horner & Keilitz, 1975); 4) utilizing subjects who were not

mentally handicapped and had previously established satisfactory toothbrushing behavior but failed to perform such behavior, (e.g., Lattal, 1969); and 5) little consensus on the training procedure, e.g., backward versus forward chaining (Linford et al., 1972; Horner et al, 1975). A paucity of empirical evidence is presently available to suggest that the severely and profoundly handicapped can be successfully instructed in good oral hygiene behaviors including toothbrushing skills, or that available self-care curricular content and methodology is appropriate and valid to achieve independent functioning in dental skills for such individuals.

There is a plethora of available research in related self-care skills utilizing operant techniques to successfully teach the severely and profoundly handicapped independent functioning in eating (e.g., Martin, Kehoe, Bird, Jensen, & Darbyshire, 1971), toileting (e.g., Baumeister & Klosowski, 1965), and dieting (e.g., Foreyt & Parks, 1975). In order to teach these skills, researchers have employed such operant techniques as: 1) discrimination training, response priming (i.e., modeling), and shaping procedures (Abramson & Wunderlich, 1972); 2) daily multiple practice, manual priming, and isolated training (Azrin & Foxx, 1972); 3) fading primes and primary reinforcement (Ball, Seric, & Payne, 1971); 4) interruption-extinction (O'Brien, Bugle, & Azrin, 1972); 5) forward chaining (Horner et al., 1975); and 6) backward chaining (Song & Gandhi, 1974). These techniques can be utilized to promote similar independence in oral hygiene skills with the severely and profoundly handicapped.

Curriculum approaches with moderately mentally handicapped individuals have not been totally successful in yielding independent toothbrushing behavior in that population (e.g., Horner & Keilitz, 1975) and, therefore, must be further modified for the severely and profoundly handicapped. Utilizing a behavioral slicing approach (Gentry & Haring, 1976), instructional content for toothbrushing can be taught to this population by breaking down the task analysis into even finer subtask movements. Another important consideration is to establish baseline behavior for each subject and alter the instructional sequence within the logical content restraints. In this manner, previously learned behaviors that fall within such logical parameters are retained by rewriting the instructional sequence to accommodate intraindividual differences. A further consideration is to utilize adaptive devices (e.g., electric toothbrush) in creating alternative method and content programming procedures. Finally, a comprehensive dental hygiene program should be undertaken. Simultaneously mastering techniques in all areas will have a better overall effect in preventing or significantly reducing oral hygiene problems in the severely and profoundly handicapped.

Through field-based evaluation and subsequent revisions, Feldman and Elliott (1979a, 1979b, 1980a) developed a multi-dimensional oral hygiene curriculum designed for this population. The manual toothbrushing dimension of their oral hygiene curriculum incorporated the following skill clusters and instructional steps:

TRAINING STEPS IN MANUAL TOOTHBRUSHING

The student_____

1. discriminates between his box containing toothbrushing supplies from other boxes in storage area.

2. carries his toothbrushing kit to the sink.

2. places his toothbrush by the sink.

4. places his cup by the sink.

5. places his toothpaste by the sink.[1]

Toothbrush Readiness Skills Cluster

6. turns on the cold water tap.

7. picks up the toothbrush by the handle.[2]

8. holds the toothbrush, placing the bristles face up under the running water for three seconds.

9. turns off the cold water tap.[3]

10. lays the toothbrush down on the flat side.[5]

Toothpaste Readiness skills Cluster

11. places the toothpaste tube in the nondominant hand.[4]

12. unscrews the cap with thumb, index, and middle finger of dominant hand in counter-clockwise direction.[4]

13. removes cap.

14. sets cap on the sink.

Toothbrush-Toothpaste Interaction Skills Cluster

15. picks up the toothbrush by the handle with the dominant hand.[4]

16. picks up the toothpaste tube from the back with the non-dominant hand.[4]

17. holds the back part of the bristles against the toothpaste tube opening.

18. squeezes the toothpaste tube at the bottom.

19. moves the toothpaste tube toward the front bristles.

20. stops toothpaste flow at the edge of the front bristles.

21. puts toothpaste tube down by the sink.

Self-Evaluation Skills Cluster

22. opens mouth.

23. inserts staining material (tablet).[3]

24. chews tablet for 10 seconds.

Main toothbrushing Skills Cluster

25. clinches teeth in biting position.

26. brings toothbrush to mouth with dominant hand.[4]

27. brushes the outside surfaces of the teeth both upper and lower on both sides and center using a forward/backward motion until staining material is removed.

28. opens mouth.

29. brushes the biting surfaces of the upper and lower teeth on both sides and in the center of the mouth using a forward/backward motion until staining material is removed.[5]

30. brushes the inside surfaces of the upper and lower teeth on both sides and in the center of the mouth using a circular motion until staining material is removed.[5,6]

Rinsing Skills Cluster

31. lays toothbrush down with the bristles face up.

32. picks up cup with nondominant hand.[4,7]

33. turns on cold water tap with dominant hand.[4,7]

34. places cup under tap with nondominant hand.[4,8]

35. fills cup.[8]

36. turns off water.[8]

37. spits out any excess toothpaste foam.

38. takes a sip of water from the cup.

39. closes mouth.

40. puts the cup down by the sink.

41. swishes water around in the mouth.

42. lowers head to sink top level.

43. spits water into sink.[9]

Surface Mouth Skills Cluster

44. picks up a hand towel with dominant hand.[4]

45. dries mouth.

46. returns hand towel to towel rack.

Toothbrush Cleanup Skills Cluster

47. picks up toothbrush by the handle with dominant hand.[4,10]

48. turns on cold water tap with nondominant hand.

49. turns toothbrush bristles face up.

50. places toothbrush under running water until bristles are free from toothpaste.

51. uses fingers in forward/backward motion to clean off unwashed toothpaste debris from toothbrush.

52. turns off cold water tap.[3]

53. returns toothbrush to sink top.

Sink Cleanup Skills Cluster

54. turns on cold water tap.

55. rubs around the inside of the sink until toothpaste residue is removed.[4]

56. washes both hands until toothpaste residue is removed.

57. turns off the cold water tap.

58. takes hand towel from the towel rack.

59. wipes hands until dry.

60. returns hand towel to towel rack.

Toothpaste Cleanup Skills Cluster

61. picks up toothpaste tube with nondominant hand.[4]

62. picks up toothpaste cap with dominant hand.[4,11]

63. screws toothpaste cap on the tube using the thumb, index, and middle finger of the dominant hand in a clockwise direction.[4]

Environmental Maintenance Skills Cluster

64. returns toothbrush, toothpaste, and cup to his box.

65. returns his box to its proper storage area.

Feldman and Elliott (1979a, 1979b, 1980a) also articulated the instructional process components (i.e. format and feedback of the curriculum. The format, designating how the content would be taught, was a forward chaining procedure. The trainer provided the student with either primary, secondary, or social reinforcement at the training step in the following manner: 1) S attempted the first step and received reinforcement; 2) S performed the first step and received reinforcement; 3) S performed the first step independently after graduated fading of feedback, attempted the second step and received reinforcement; 4) S performed steps 1 and 2 independently after graduated fading feedback for step 2 and attempted step 3 and received reinforcement.

The feedback, designating what the trainer would do to assist the student at the training step, was a 6 stage operant procedure. The trainer would sequentially provide the following feedback: 1) no help (5 seconds); 2) nonspecific verbal prompt (e.g., "brush teeth"); 3) verbalize instruction for step (e.g., "dry mouth"); 4) demonstrate step with verbal instruction; 5) physical guidance (e.g., hand over hand) and verbal instruction; 6) repeat step 5 for additional practice. At steps other than at the training level, the trainer would provide feedback utilizing step 1 and then step 5 until the entire task was completed.

Other possible format modifications included changing to a backward chaining procedure. Behavioral slicing of the content suggested by Linford and his associates (1972) would be appropriate for this format modification.

Additional method modification would include changing from the manual method to one that would utilize an adaptive device. Utilizing an electric toothbrush with angular bristles would eliminate motion procedures with the toothbrush and allow manual placement of the device to the tooth surface.

To encompass a total dental hygiene program for the severely and profoundly handicapped, suggested instructional content was developed for gum massage and flossing.

Using an oral irrigation appliance (e.g., Water Pik[1]) assisted in cleaning away loose food particles and massaging the gums through the use of pressurized water. This device also benefited those individuals who had difficulty in swishing water around in the mouth and spitting it out.

The oral irrigation component of the oral hygiene curriculum included the following skill clusters and instructional steps:

TRAINING STEPS IN UTILIZING AN ORAL IRRIGATION APPLIANCE

The student _____

Appliance Cover Skills Cluster

1. removes appliance cover.
2. turns cover upside down.
3. places cover under tap.
4. fills cover with lukewarm water.
5. turns off water.
6. places cover upside down on appliance top.
7. pushes cover down until secured (hears lock click).

Water Hose-Jet Tip Interaction Skills Cluster

8. removes handle of coiled water hose from base.

9. inserts color coded jet tip into open end of hose with a clockwise twist of thumb, index, and middle fingers until secured (hears lock click).

10. sets pressure dial at color coded "low".

Jet Tip Skills Cluster

11. grasps jet tip with thumb and forefinger.

12. leans over basin until chin is at sink level.

13. places elbow up.

14. places jet tip in mouth.[2]

Main Oral Irrigation Skills Cluster

15. uses other hand to push down color coded "on" button.

16. lets water run out of his mouth into the sink.

17. directs pulsating water from jet tip along the lower outside gum line, pausing three seconds between each tooth.

18. directs pulsating water from jet tip along the upper outside gum line, pausing three seconds between each tooth.

19. directs pulsating water from jet tip along the lower inside gum line, pausing three seconds between each tooth.

20. directs pulsating water from jet tip along the upper inside gum line, pausing three seconds between each tooth.

Appliance Termination Skills Cluster

21. presses down on the color coded "off" button.

22. empties the cover into the sink.

23. replaces cover right side up.

24. removes jet tip by twisting it counterclockwise and pulling up.

25. coils hose and inserts it into hose receptacle.

26. cleans sink.

Utilizing dental floss appropriately will help prevent plaque formation and the build up of calculus. This hard calcified substance is formed by the calcification of plaque. Plaque has been shown to be the prime etiological factor in peridontal, or gum, disease. Research indicates that certain mentally handicapped children are particularly susceptable to this peridontal disease, leading to the most significant causal factor in poor oral hygiene (Nickol, 1973; Schuh, 1963). Since proper flossing habits would help attenuate such conditions, this dimension of the curriculum incorporated the following instructional sequence:

MANUAL FLOSSING TRAINING SEQUENCE

The student _____

Floss Preparation Skills Cluster

1. removes 18 inches of floss from container.
2. cuts floss from container.

Wrapping Skills Cluster

3. anchors floss by wrapping ends two or three times around each middle finger.[1]
4. leaves two inches of floss between middle fingers.
5. pulls floss taut between middle fingers.

Finger-Thumb Interaction Skills Cluster

6. places thumbs opposite to middle fingers (i.e., pinch).
7. guides floss with thumbs for top teeth.
8. guides floss with index fingers for lower teeth.

Main Flossing Skills Cluster

9. uses up/down scraping motion on the side of each tooth (five times each direction).

10. uses backward/forward motion, sawing in between teeth (five times each direction).

11. unwinds floss from middle finger of one hand while winding used floss around other middle finger (as needed).

Cleanup Skill

12. disposes used floss into trash container.

Since some severely and profoundly handicapped individuals may exhibit motoric difficulty in flossing, adaptive devices are commercially available (e.g., Flossmate[2]). These devices could help to eliminate motoric problems associated with flossing content steps 2,3,6,7,8, and 11, since the dental floss handle designed with a short tapered grip would allow for correct manipulation around the dental arch. The elongated plastic fingers would make it easier to reach between the teeth. Therefore, the following instructional sequence for adaptive flossing was substituted for the manual flossing component:

ADAPTIVE FLOSSING TRAINING SEQUENCE

The student _____

Preparation Skills Cluster

1. removes 12 inches of dental floss.

2. wraps one end of the floss around the button in the center of the device one time.

3. threads the other end into the slot, past the tips, and back to the button.

4. squeezes prongs slightly while pulling floss taut.

5. winds floss around button two times.

Main Adaptive Flossing Skills Cluster

6. uses up/down scraping motion on the side of each tooth (five times in each direction).

7. uses backward/forward motion, sawing in between teeth (five times in each direction).

8. unwinds floss from middle finger of one hand while winding used floss around other middle finger (as needed).

Termination Skills Cluster

9. disposes of used floss in appropriate container.

10. returns device to appropriate location.

Since the content of oral hygiene skills can be extremely cumbersome and unwieldy due to the behavior slicing approach, the subsequent programming and evaluation may also appear, at least on the surface, to be overwhelming. To alleviate possible trainer frustration due to excessive recording requirements, entry level procedures, method, feedback, data collection, and evaluation are standardized for the program. The suggested format for educational programming summarizes essential information necessary to commence training at a specific step from the content list:

SUGGESTED FORMAT FOR EDUCATIONAL PROGRAMMING

Area: Oral Hygiene/Self-Care

Subarea: Toothbrushing

Goal: To expand manual toothbrushing skills.

Cluster: Materials Preparation Skills

Objective: _____ will perform (specify training step from list) after attaining five consecutive positive responses to a verbal command on each level of the task analysis. (Training step 4 is used in this task analysis.)

Essential Subtasks/Task Analysis:

The student will:

Level 1. place his cup by the sink with no help.

Level 2. place his cup by the sink with a nonspecific verbal prompt (e.g., "place cup").

Level 3. place his cup by the sink when given verbal instruction to do so (e.g., "cup by sink").

Level 4. place his cup by the sink after trainer demonstrates and gives verbal instruction (e.g., cup by sink).

Level 5. place his cup by the sink with physical guidance (e.g., hand over hand) and verbal instruction (e.g., cup by sink).

Entry Level Procedure: start at step 1 and assess downward with 4 attempts at each step.

Suggested Method: forward chaining

Suggested Materials: cup

Suggested Prompts/Cues: as task analysis level indicates.

Suggested Reinforcers: verbal praise bridged with tangible reward (e.g., sugar-free gum).

Suggested Type of Data Collection: frequency data (correct/incorrect) on at least 5 trials per training session.

Evaluation: Three consecutive correct responses at each level with a minimum of 3 training sessions in order to move to next step in the skills cluster.

Trainers should concentrate on a specific skill pair (e.g., steps 4 and 5) in a skills' cluster (e.g., materials preparation) to maximize instructional efforts when utilizing the forward chaining procedure. Following baseline on the entire sequence since the skills are not sequenced by difficulty, the first step below independence is pinpointed for entry and training level behavior. The trainer identifies the skill cluster and proceeds to the appropriate data collection sheet (Fig. 1). The entry level establishes the cues necessary to perform the target step while the training level will change over sessions. Responses are recorded by sessions and trials. A "Y" indicates a correct response and the number below the diagonal reflects the cue level (e.g., nonspecific verbal prompt).

TOOTHBRUSHING PROGRAM DATA COLLECTION SHEET

MATERIALS PREPARATION SKILLS CLUSTER

Performance over Trials

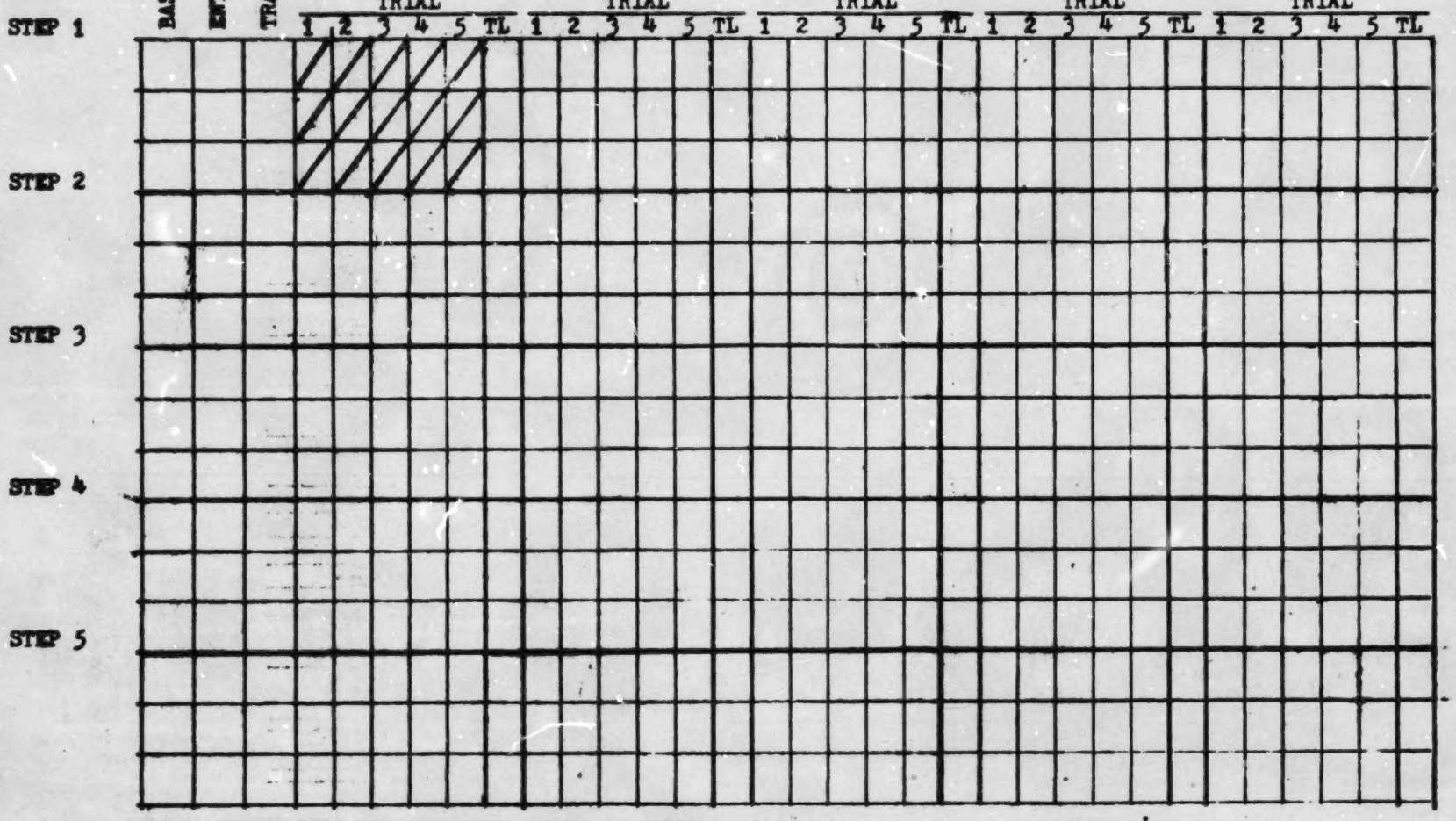


Figure 1. The data collection sheet for the manual toothbrushing dimension: Materials preparation skills' cluster.

TOOTHBRUSHING PROGRAM DATA COLLECTION SHEET

MATERIALS PREPARATION SKILLS CLUSTER

Performance over Trials

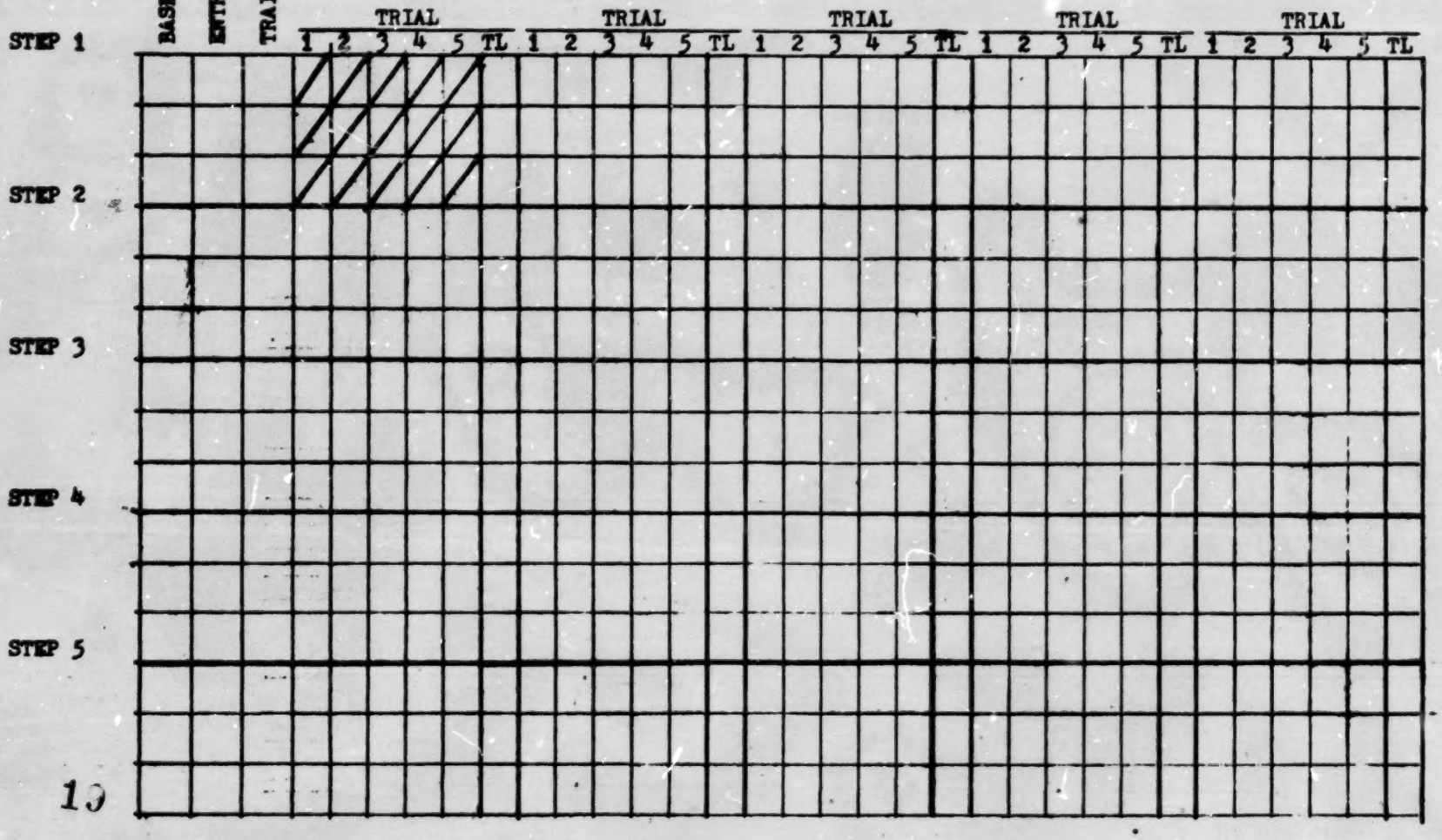


Figure 1. The data collection sheet for the manual toothbrushing dimension: Materials preparation skills' cluster.

When the response is negative (e.g., N) at the specified training level, the number below the diagonal indicates the cue level necessary to achieve the correct response. The paired skill is introduced into the training procedure after the student performs the instructional step without assistance. The entry and training levels are established for the paired skill and data is collected only for that step. All other steps require either no help or feedback level 5 to complete the skills sequence.

As data collection is limited to the training step and the eventually paired step, the evaluation component maintains the same perspective. Evaluation is measured in a formative fashion (i.e., by trial) in the cluster where the training step is located. Figure 2 presents the evaluation sheet for the materials preparation skills cluster in the manual toothbrushing dimension. The rectangular blocks are color-coded with green (G) indicating a correct response while red (R) indicates an incorrect response. The number specifies the cue level necessary to perform the step. Below the diagonal, the date is recorded. A series of G-1's would be needed prior to initiation of the pairing procedure. At that point, evaluation focuses on the next training step. If retraining is indicated, data collection and evaluation return to the appropriate step.

In the manual toothbrushing dimension presented earlier, a self evaluation skills cluster was included. The rationale for this cluster was to provide the trainer and student with a visual evaluative overlay for the main toothbrushing skills. As the staining

TOOTHBRUSHING PROGRAM EVALUATION SHEET

1

MATERIALS PREPARATION SKILLS CLUSTER

Teacher_____
Student_____

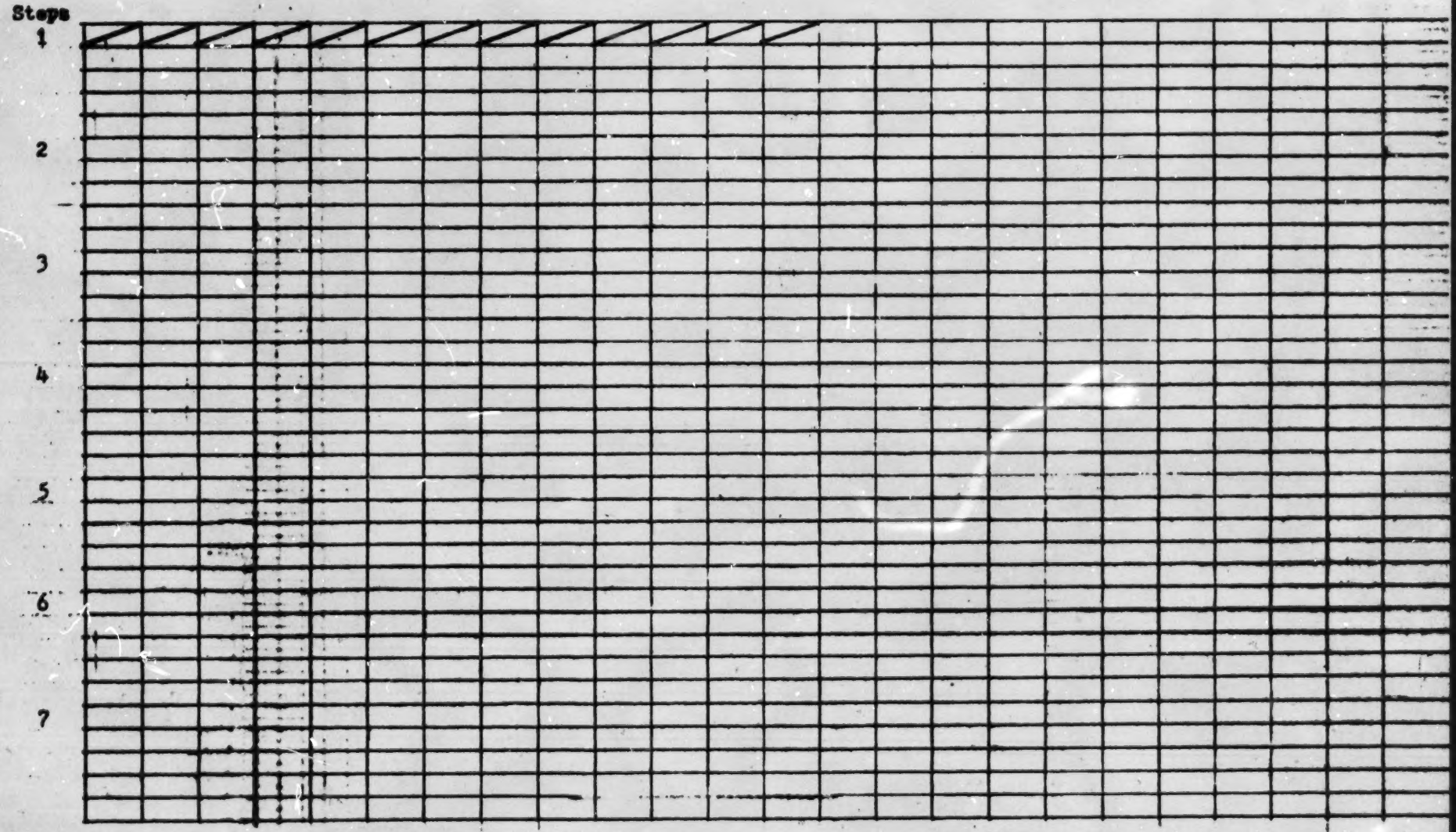


Figure 2. The evaluation sheet for the materials preparation skills' cluster in the manual toothbrushing dimension.

TOOTHBRUSHINC PROGRAM EVALUATION SHEET

1

MATERIALS PREPARATION SKILLS CLUSTER

Teacher_____
Student_____

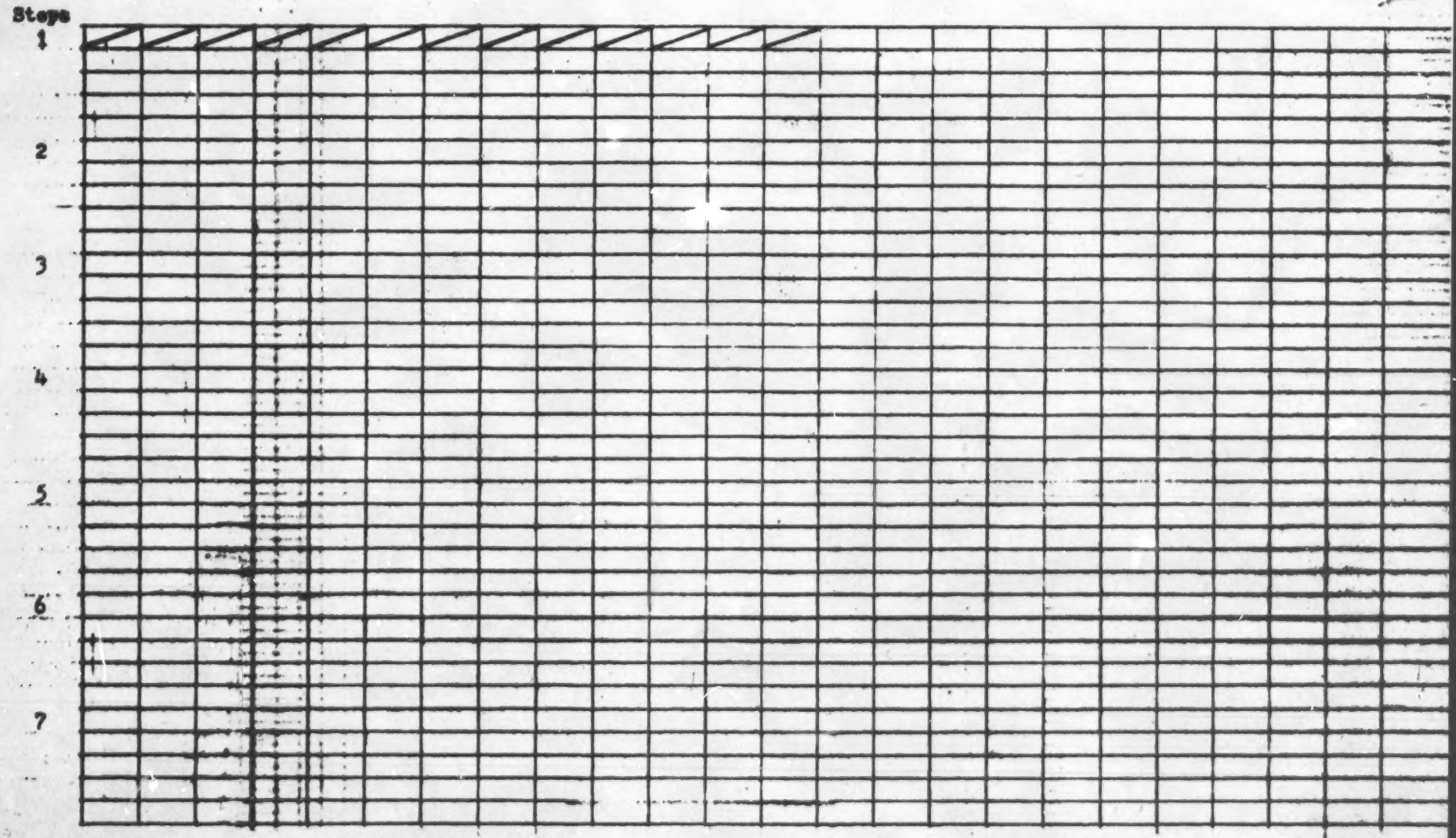
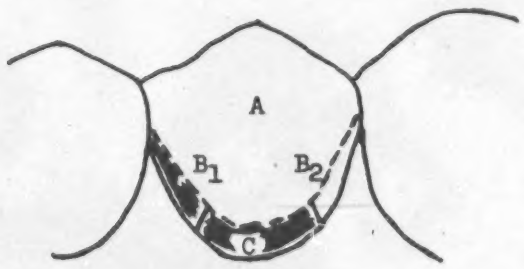


Figure 2. The evaluation sheet for the materials preparation skills' cluster in the manual toothbrushing dimension.

material was removed by the student, an objective termination point was reached for that particular section of the mouth.

This staining material is again utilized later in the oral hygiene program but in a summative fashion (i.e., longer evaluative delay). Tooth staining in this respect helps determine particular deficits by mouth region and subsequent extrapolation to one or more of the three major components of the oral hygiene curriculum. This evaluative technique is called Bacterial Plaque Scoring (Fedi, Siegel, & Lockhart, 1973). The procedure is accomplished by dividing the mouth into four sections utilizing the middle front teeth as the departure point. After staining the mouth with plaque disclosing material, the most stained tooth is chosen in each section. The tooth number is recorded and the amount of plaque is numerically determined for the facial (i.e., outside) and lingual (i.e., inside) surfaces. Figure 3 presents a diagram of the surface areas and their concommitant score values by quadrant, that is, higher score values are associated with more critical surface regions (e.g., between teeth.



B_1, B_2-between teeth

C-gum line

A-remaining tooth surface

Figure 3. Diagram of tooth surface areas.

According to Figure 3, the subject's selected tooth in this particular section revealed disclosing material on 2 of the 4 tooth quadrants in the facial position. The score for the tooth in this position is 5 (i.e., B_1= 3 and C= 2). The scoring continues with the assistance of a mouth mirror for the lingual position and then the procedure is repeated for the other three mouth sections. Figure 4 presents a chart for recording plaque formation.

Date:

TOOTH NO.	FACIAL				LINGUAL				TOOTH SCORE
	B_1	C	B_2	A	B_1	C	B_2	A	
	3	2	3	1	3	2	3	1	
	B_1	C	B_2	A	B_1	C	B_2	A	
	3	2	3	1	3	2	3	1	
	B_1	C	B_2	A	B_1	C	B_2	A	
	3	2	3	1	3	2	3	1	
	B_1	C	B_2	A	B_1	C	B_2	A	
	3	2	3	1	3	2	3	1	
					TOTAL SCORE FOR ALL TEETH				

Figure 4. Chart for recording plaque formation.

The total plaque score, composed of the scores of the 4 teeth in the facial and lingual positions, is compared to the maximum score of 72. Low scores are more favorable than high scores.

Possible skill deficits in one or more of the oral hygiene components should be extensively reviewed as the plaque score approaches and/or exceeds 18. A member of this re-evaluation team should be a dentist, oral hygienist, or dental technician. Feldman and Elliott (1980b) discussed how this transdisciplinary approach lends itself to increased communication between diverse disciplines as well as leading to the establishment of cross-teaching critical aspects of common concern to the teachers of the severely and profoundly handicapped and their dental health providers.

Toothbrushing Content Reference Notes

1. steps 3, 4, and 5 interchangeable
2. steps 6 and 7 interchangeable
3. optional step
4. opticnal hand reference but student remains consistent
5. or at least 30 seconds if staining material not used
6. steps 27, 28, 29, and 30 interchangeable; use soft bristle brush
7. steps 32 and 33 interchangeable
8. may be inserted after step 6
9. repeat steps 38, 39, 40, 41, 42, and 43 as necessary
10. steps 47 and 48 interchangeable
11. steps 61 and 62 interchangeable

Oral Irrigation Content Reference Notes

1. slowly increase pressure dial to "high" setting over trials
2. avoid soft tissue under the tongue during irrigation

Dental Floss Reference Notes

1. loops may be tied and placed around middle fingers

General Reference Notes

1. Teledyne Water Pik, 1730 E. Prospect Street, Fort Collins, Colorado 80521
2. Butler Flossmate, John O. Butler Company, Chicago, Illinois 60611

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